EO/US
PCT/GB00/02713

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing: 18 January 2001 (18.01.01)	
International application No.: PCT/GB00/02713	Applicant's or agent's file reference: SC/FP5862875
International filing date: 14 July 2000 (14.07.00)	Priority date: 14 July 1999 (14.07.99)
Applicant: LILL, Richard, Mark et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International preliminary Examining Authority on:

03 November 2000 (03.11.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer: J. Zahra Telephone No.: (41-22) 338.83.38

Form PCT/IB/331 (July 1992)

3764210

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
SC/FP5862875		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/02713	14/07/2000	14/07/1999
International Patent Classification (IPC) or national classification and IPC C23C14/50		
Applicant DORMER TOOLS (SHEFFIELD) LIMITED		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 8 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
03/11/2000	24.07.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Piber-Goldbacher, U Telephone No. +49 89 2399 7327

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/02713

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

5-8	as originally filed			
9	as received on	05/02/2001	with letter of	01/02/2001
1-4	as received on	06/07/2001	with letter of	04/07/2001

Claims, No.:

1-8	as received on	06/07/2001	with letter of	04/07/2001

Drawings, sheets:

1/4-4/4	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:
   ☐ the claims, Nos.:
   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims 1-8
	No:	Claims
Inventive step (IS)	Yes:	Claims 1-8
	No:	Claims
Industrial applicability (IA)	Yes:	Claims 1-8
	No:	Claims

2. Citations and explanations
   see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1:US-A-4 911 784 (HENSEL BERND ET AL) 27 March 1990
D2:US-A-5 688 389 (TAYLOR CLIFFORD L ET AL) 18 November 1997

Novelty:

The subject-matter of the independent claim 1 is novel, since none of the cited documents reveals a holder for supporting a series of drills in a vapour deposition chamber wherein the tips of the drills are projecting outwards from the holder and the shanks of the drills are supported by a perforated support wall and stop means.

The subject-matter of the independent claim 8 is novel, since none of the cited documents reveals a method of vapour-deposition coating the tips of a series of drills which are inserted into a hollow holder, wherein after the deposition of the coating a gas is admitted to circulate through the hollow interior of the holder.

Prior Art:

D1 discloses (cf. col. 8, line 21-26 and fig. 8) a holder for supporting a series of drills with an array of apertures and with supports being provided for the inserted drills and stop means for locating the tips of drills of the same diameter projecting to substantially the same extent from the wall. The tips of the drills do however not project outward from the holder but inward. Thus, the tips can not be coated separately from the rest of the drill.

D2 discloses (cf. col. 3, lines 40-46 and col. 10, lines 22-46) a hollow carrier for substrates to be coated, with perforated walls to receive the substrates. Those parts of the substrate which are to be coated project outward from the wall, which allows a

selective coating of a portion of a substrate. In D2 the carrier is used for coating cathode ray tubes. Fig. 14 discloses a collar (cf. Nr. 81) which supports the end of a cathode ray tube, but there are no support walls and stop-means inside the carrier.

Inventive Step:

The design of the holder including the perforated support wall and the stop means makes it possible to coat only the tip of the drills and to cool the shanks. The technical problem solved by the subject-matter of claim 1 is to provide a drill-holder for separately coating the tips and cooling the shanks of the drills.

The effect of the gas circulation through the interior of the holder is that the shanks of the drills are cooled (cf. page 9). The technical problem solved by the subject-matter of claim 8 would therefore be to provide a method for coating the tips of drills wherein the process cycle time can be reduced by an effective cooling.

up, engaging those stems in a manner which permits them to rotate freely. During the vapour deposition process, which is typically performed at a temperature of 500°C under high vacuum, the towers are rotated continuously with the turntable. Each tower is also rotated by the drives to the spindles on which they are mounted, so that each bank of drills is intermittently exposed to the plasma zones in the outer peripheral region of the chamber to assist the evenness and spread of coating of the exposed tips.

When the coating process has been completed nitrogen is introduced into the chamber to reduce the vacuum and assist cooling. The gas path between the spaced collars 58,64 the lids allows a convection flow through the interior of each tower so that the drill shanks are also cooled, the flow permeating the full height of the tower from the gaps at the drill flute recesses in the hollow walls. The convection flow through the vented lid gives a more uniform cooling the process cycle time can thus be reduced, without risk of oxidation on the surface of the drill shanks when they are exposed to the surrounding air.

METHOD AND MEANS FOR DRILL PRODUCTION

This invention relates to the production of drills and in particular to the application of coatings, such as ceramic coatings, to drills.

It is known to coat the point and flutes of a fluted high speed steel drill with a ceramic such as titanium nitride or aluminium titanium nitride to improve wear or cutting performance. The application of such coatings adds considerably to the cost of the drill, however.

It would be possible to lower the cost by limiting the coating to the drill point and the region immediately behind the point, but the cost of the coating material although significant, is only one factor of the total cost. Ceramic coatings are typically applied by physical vapour deposition (PVD) in a vacuum chamber, by such processes as evaporative arc or electron beam or sputtering, and the considerable cost of operating such equipment is a major factor, but there is little difference in process time with the length of the drill being coated.

US 4911784 discloses a holder loaded with drills arranged internally of the holder in herringbone fashion, the drills to be coated with a hard coating of titanium aluminium nitride.

The present invention aims to provide an improved method and means by which a coating can be applied to

drills, in particular to apply a coating to a limited portion at and near the drill tip to provide a wider commercial application for coated drills.

According to one aspect of the invention, a hollow holder is provided for supporting a series of drills in a vapour deposition chamber to allow a ceramic coating to be deposited on regions of the drills extending from their tips, the holder comprising at least one perforated outer wall provided with an array of apertures into which the drills can be inserted, characterised by the drills are inserted with said regions projecting outwards from the holder, a support wall within the hollow interior of the holder for the or each perforated outer wall parallel with and spaced from the outer wall and provided with a corresponding array of apertures for locating the inserted drills with their shanks substantially parallel, stop means within the hollow interior of the holder spaced inwardly of the or each support wall for locating the tips of drills of the same diameter projecting to substantially the same extent from the outer wall, the hollow interior of the holder and the locating of the drills being such that the part of each drill inwards of the outer wall is shielded from the exterior but is exposed to the atmosphere within the interior of the holder.

The stop means can be formed by a back wall in the interior of the holder, parallel to said outer wall and to said support wall.

Typically, the active zone of a PVD chamber is close to its inside wall. To assist even application of the coating, it is known to rotate the articles to be coated to vary continuously the exposure of the surfaces to the vapour. Thus, by using a turntable the articles can be circulated along the periphery of the rotary path. It is also known to mount articles to be coated on planetary carriers rotating on axes parallel to the turntable axis, so that the articles are given a double rotation.

To aid the efficient use of such a planetary motion system, the holder may have a hexagonal outer periphery, alternate walls of said holder being perforated with an array of apertures into which the drills can be inserted.

The walls of the hollow holders according to the invention may be relatively thin to keep the thermal mass of the holders low, giving quicker heating and cooling at the beginning and end of the vapour deposition cycle, so as to reduce the cycle time. It is known to admit an inert gas into the chamber at the end of the cycle to increase the rate of cooling and preferably the holders are so arranged that the gas is allowed to circulate

through the hollow interior of the holders also. However, the shanks of the drills must be shielded from the deposition material if they are not also to be coated, so the tops of the holders must be closed.

In accordance with a preferred feature of the invention, the holder is provided with a lid that shields the hollow interior from above, said lid being provided with a passage for facilitating the venting and cooling of said interior after application of the PVD coating.

According to another aspect of the invention there is provided a method of vapour-deposition coating the tips of a series of drills in which the drills are inserted in a hollow holder having a polygonal plan form with the tips to be coated projecting from at least one outer face of said polygonal form, the holder with the inserted tips being rotated in a vapour deposition chamber to allow each of the drill tips to project from the holder towards the periphery of the chamber for at least a part of the processing period, and a gas being allowed to circulate through the holder interior after deposition of the coating to assist cooling of the drills.

The invention will be described by way of example with reference to the accompanying drawings, in which:

Figs. 1 to 3 are side, plan and transverse sectional views respectively of a first form of holder according to the invention,

Figs. 4 and 5 are side and plan views of another

CLAIMS

1. A holder (2) for supporting a series of drills (D) in a vapour deposition chamber (V) to allow a ceramic coating to be deposited on regions of the drills (D) extending from their tips, the holder (2) comprising at least one perforated outer wall (4) provided with an array of apertures (6) into which the drills (D) can be inserted, characterised by the drills (D) are inserted with said regions projecting outwards from the holder (2), a support wall (8) within the hollow interior of the holder (2) for the or each perforated outer wall (4) parallel with and spaced from the outer wall (4) and provided with a corresponding array of apertures for locating the inserted drills (D) with their shanks substantially parallel, stop means (10) within the hollow interior of the holder (2) spaced inwardly of the or each support wall (8) for locating the tips of drills (D) of the same diameter projecting to substantially the same extent from the outer wall (4), the hollow interior of the holder (2) and the locating of the drills (D) being such that the part of each drill (D) inwards of the outer wall (4) is shielded from the exterior but is exposed to the atmosphere within the interior of the holder (2).

2. A holder (2) according to claim 1 wherein the stop means comprise a back wall (10) in the interior of the holder (2), parallel to said outer wall (4) and to

said support wall (8).

3. A holder (2) according to claim 1 or claim 2 having a polygonal outer periphery, said at least one outer wall (4) forming at least one face of said periphery.

4. A holder (2) according to claim 3 and having a hexagonal outer periphery, alternate walls (4) of the holder (2) being perforated with an array of apertures (6) into which the drills (D) can be inserted.

5. A holder (2) according to any one of the preceding claims provided with a lid (52) shielding the hollow interior from above, said lid (52) being provided with a passage for permitting gas flow between the interior and exterior of the holder (2).

6. A holder (2) according to any one of the preceding claims provided with means (32,34,36) for stacking of the holder (2) with a second holder (2) having a corresponding outer wall (4) configuration.

7. A holder (2) according to claim 6 having top and bottom faces (34,36) for abutment together whereby the two corresponding holders (2,2) can be supported one on the other, and a flange (32) projecting over said abutment of the faces (34,36) for providing a closure for

the joint between the abutting faces.

8. A method of vapour-deposition coating the tips of a series of drills (D) in which the drills (D) are inserted in a hollow holder (2) having a polygonal plan form with the tips to be coated projecting from at least one outer face (4) of said polygonal form, the holder (2) with the inserted tips being rotated in a vapour deposition chamber (V) to allow each of the drill tips to project from the holder (2) towards the periphery of the chamber (V) for at least a part of the processing period, and a gas admitted to the chamber (V) after deposition of the coating being allowed to circulate through the hollow interior of the holder (2).

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
SC/FP5862875		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/GB 00/ 02713	14/07/2000	14/07/1999
Applicant		
DORMER TOOLS (SHEFFIELD) LIMITED		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 2

   [X] as suggested by the applicant.

   [ ] None of the figures.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

International Application No
/GB 00/02713

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 · C23C14/50 C23C14/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C23C B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 688 389 A (TAYLOR CLIFFORD L ET AL) 18 November 1997 (1997-11-18) column 9, line 22 -column 10, line 46; figures 14,21-23	1-11
A	US 4 911 784 A (HENSEL BERND ET AL) 27 March 1990 (1990-03-27) column 8, line 20 -column 9, line 14	1-11

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 October 2000	13/10/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ekhult, H

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
/GB 00/02713

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5688389 A	18-11-1997	US 5489369 A	06-02-1996
		US 6068738 A	30-05-2000
		AU 1084695 A	22-05-1995
		CA 2175058 A	04-05-1995
		CN 1139957 A	08-01-1997
		JP 9504575 T	06-05-1997
		WO 9512007 A	04-05-1995
		US 5620572 A	15-04-1997
US 4911784 A	27-03-1990	DE 3837487 A	10-05-1990
		AT 80675 T	15-10-1992
		CA 2002322 A	04-05-1990
		DE 58902295 D	22-10-1992
		EP 0371252 A	06-06-1990
		JP 3028384 A	06-02-1991

INTERNATIONAL SEARCH REPORT

Int [redacted] Application No
PCT/[redacted]00/02713

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C23C14/50 C23C14/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C23C B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 688 389 A (TAYLOR CLIFFORD L ET AL) 18 November 1997 (1997-11-18) column 9, line 22 -column 10, line 46; figures 14,21-23	1-11
A	US 4 911 784 A (HENSEL BERND ET AL) 27 March 1990 (1990-03-27) column 8, line 20 -column 9, line 14	1-11

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 October 2000	13/10/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Ekhult, H

INTERNATIONAL SEARCH REPORT

Information patent family members

Int Application No
PCT/[redacted] 00/02713

Patent document cited in search report	Publication dat	Patent family member(s)	Publication date
US 5688389 A	18-11-1997	US 5489369 A	06-02-1996
		US 6068738 A	30-05-2000
		AU 1084695 A	22-05-1995
		CA 2175058 A	04-05-1995
		CN 1139957 A	08-01-1997
		JP 9504575 T	06-05-1997
		WO 9512007 A	04-05-1995
		US 5620572 A	15-04-1997
US 4911784 A	27-03-1990	DE 3837487 A	10-05-1990
		AT 80675 T	15-10-1992
		CA 2002322 A	04-05-1990
		DE 58902295 D	22-10-1992
		EP 0371252 A	06-06-1990
		JP 3028384 A	06-02-1991